ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Effective Load Carrying Capability of Wind Generation: Initial Results with Public Data

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at

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Overview

Background

- California RPS Integration Study finds the capacity credit for wind generation is roughly equal to its capacity factor
- SCE asked Analysis Group to review study methods and make an independent assessment

Methodology

- LOLP methods used in the RPS Study are generally reasonable, but their implementation is unclear
- The use of confidential ISO data defeats the purpose of transparency

Data issues

- Public data on loads, imports and hydro dispatch must be used in the absence of the ISO data available to the RPS study

Initial results

- Base case results do not replicate RPS study results
- ELCC for 2002 is 13% using SCE wind data, not the 22-23.9% found in the RPS study

Methodology

- Formally, we define the probability that in a given hour available capacity is less than load. We call this the LOLP for hour i, or $LOLP_i$

$$\mathbf{LOLPi = Pr\ (?\ C_j < L_i),} \qquad \mathbf{(1)}$$

where Cj is the random variable representing the capacity of generator j in hour i and L_i is the load in hour i.

- The annual LOLE index is defined over all hours of the year i as

$$\mathbf{LOLE = \ ?\ LOLP_i.} \qquad \mathbf{(2)}$$

- Effective load carrying capacity (ELCC) is the amount of new load, call it ?L, that can be added to a system at the initial LOLE, which we call $LOLE_I$, after a new unit with capacity $?C_{max}$ is added. If we denote the random variable representing the available capacity of $?C_{max}$ by ?C, then solving (3) for ?L gives an implicit definition of ELCC.

$$\mathbf{LOLE_I = \ ?\ Pr\ (?\ C_j + ?C < L_i + ?L)} \qquad \mathbf{(3)}$$

- In normalized form

$$\mathbf{ELCC = ?L/?C_{max}} \qquad \mathbf{(4)}$$

Data issues

RPS study relied on ISO data for 2002 that is not publicly available

- Hourly hydro generation data
- Proprietary database for outages

Analysis Group relies upon public data from ISO released by FERC in connection with the Western Energy Markets Investigation

- Hourly hydro from 2000 used as a proxy for 2002
- Adjustments to load required to account for SMUD withdrawal from ISO control area
- Forced outage rates from Henwood database

Analysis Group initial results

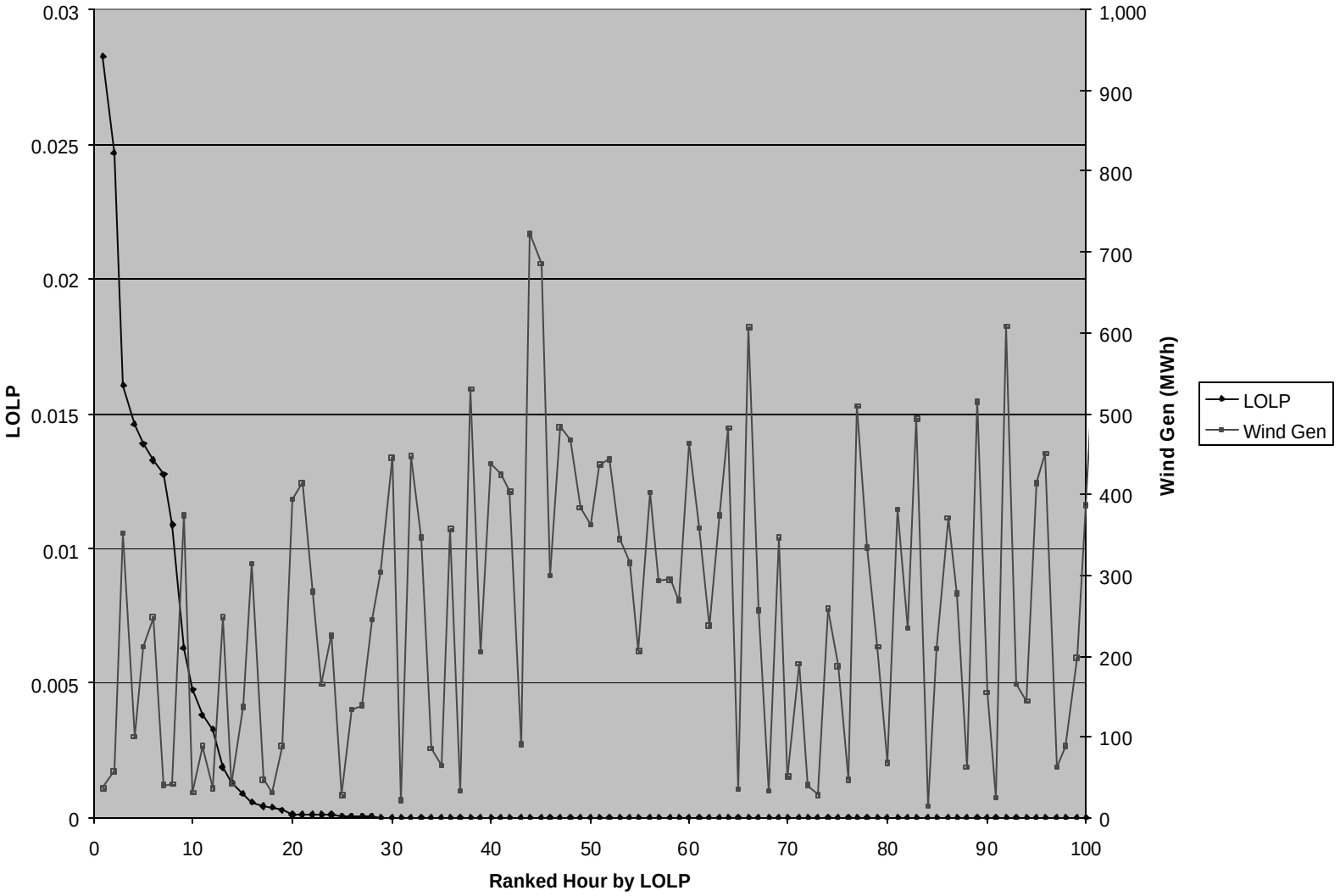
ELCC depends upon coincidence of wind output with high LOLP hours

- There is substantial year to year variation in this correlation
- Correlation was comparatively low in 2002; higher in 2003

ELCC is also sensitive to the concentration of LOLE in time; i.e. is 95% of LOLE in the top 20 hours or the top 50 hours

- We use “perfect load shaving” hydro dispatch in base case; this tends to concentrate the LOLE to the top load hours
- The LOLE can be spread out more by tightening the supply/demand balance and raising the total LOLE
- RPS results appear to have a bigger LOLE spread than Analysis Group base case (see Figures 3.1 and 3.2 and compare with following chart)
- It is unclear why the RPS study finds 50 high LOLP hours instead of 20

2002 Base Case



Next steps

Adopting RPS Study results is premature

Analysis Group will conduct additional ELCC sensitivity studies

- Disaggregated wind data
- Representation of hydro dispatch
- Sensitivity to forced outage rates
- 2003 data

Regulation and load following analysis in RPS Study also requires further review

Translating these technical results into policy requires further discussion